Answer to Referee report #2

Many thanks for your comments.

- Comment on subsection 4.2:
We have performed two changes: (1) Those three paragraphs have been moved to the introduction in section 4. We reshape this introduction to stress the differences between our model and other models from the existing literature, including those three paragraphs previously included in section 4.2. (2) The paragraphs have been shortened. The introduction in section 4 maintains the first paragraph and the following paragraphs are as follows:

"The model differs from existing literature on CGEs models with MNEs in the way of modelling MNEs' technologies. Jensen and Tarr (2012) extend their previous contributions (Jensen, Rutherford and Tarr, 2007; Rutherford and Tarr, 2008) to consider a multi-regional framework. They include a Dixit-Stiglitz-Ethier formulation in imperfectly competitive sectors, which leads to potential increases in both consumers' welfare and producers' productivity through a higher number of product varieties (i.e., more firms producing those services, due to the arrival of MNEs). However, apart from their use of an imported intermediate, MNEs' technology is the same as the one from national firms operating in the same sector.

Lakatos and Fukui (2013) have built a multiregional CGE model with MNEs. They have also constructed a database on foreign affiliates' sales for the whole world with a high sectoral detail (Fukui and Lakatos, 2012)[1]. The differentiation of the technologies of MNEs and national firms within each sector in the CGE are based on the MNEs' shares in sales and in a proxy for differences in capital-labour ratios for the two types of firms. Lakatos and Fukui (2012) do not differentiate the value added provided by both type of firms which is assumed to be proportional to sales, so that they introduce a further degree of symmetry between both national firms and MNEs. We introduce the real shares on value added components and the shares in production, which are worth to grasp differences in productivity.

These recent CGE approaches reflect a trade-off between expanding the regional coverage of the model and being precise with the differential technologies of national firms and MNEs across sectors. Further, the models just commented capture the impact of MNEs by relying on barriers to FDI in order to make FDI movements endogenous. Those barriers are difficult to be estimated empirically. By contrast, in our model, we get the real data on the variations of the FDI net position across sectors and derive their impact.

Finally, it must be noted that due to the high unemployment rate in the Spanish economy, instead of using the common assumption of full employment in labour market, the model includes unemployment in a way derived from trade unions models. Next we present a brief description of the model, and the full set of equations is displayed in Appendix I."

Lakatos, C. and Fukui, T. (2013) "Liberalization of Retail Services in India: A CGE model", U.S. International Trade Commission, Office Of Economics Working Paper No. 2013-03A, Available at: http://www.usitc.gov/research_and_analysis/staff_products.htm

[1] In our view, the main contribution of this database is that it provides information for the sales of MNEs in many countries and sectors for which formerly there was no information at all.

- Equations: See the new Appendix below.

- Erratum page 10 line 26: Modified.

- Comment on section 5: Modified.

- Comment on section 6: The parameter β has been added to the sensitivity analysis. The benchmark value of the parameter (1.5) has been change to 20 (to display a very rigid wages framework) and to 0.001 (to show a very flexible wages framework). This involves a change in Table 6 (see below) and in some paragraphs, as explained below:

(1) In section 6, the second paragraph has been updated:

"The sensitivity analysis focuses on the elasticities related to the welfare and production functions. In the first line in Table 6 is displayed the base scenario "All divestments" for "National acquisitions" and "Closures". The benchmark elasticities have been duplicated and halved, except for two parameters: The case of the Armington elasticities (where a more competitive international framework has been tested), and β (where very rigid and flexible wages scenarios have been tested)."

(2) In section 6, the third paragraph has been updated:

"(…) among consumption goods has a small effect on labour market variables. The elasticity of substitution capital-labour affects the capital and labour demands. Nevertheless, the labour market variables are not significantly affected. The higher Armington elasticity reflects that more competitive goods markets temper adjustments in the labour market. Finally, a lower β parameter (i.e., very flexible wages scenario) and a higher β (i.e., very rigid wages scenario) show the expected results: a lower (higher) β generates a lower (higher) change in employment and unemployment and higher (lower) wages adjustment."

(3) Additional lines at the bottom of Table 6 (see next page).

- Comment on conclusions: 2nd and 3rd paragraphs (beginning from the bottom) have been merged including an additional comment:

"It could be expected a priori that national acquisitions of foreign MNEs would be good for the host economy. Our analysis points out that this is the case in terms of unemployment reductions and employment creation. However, due to the impact of national acquisitions on capital remuneration (i.e., on firms' profits), it turns out that welfare diminishes in the host economy. Additionally, GDP could also go down in some cases. In this sense, our results contrast with the optimistic view of divestments derived by Myro et al. (2008) from the years of the construction boom in Spain, using econometric estimations. While we cover the final years of the construction boom and the beginning of the crisis, we share with those authors the view that the scope of the phenomenon is rather limited but find more potential for damaging impacts. Sectoral divestments in the Spanish economy do clearly have a considerable negative effect for the Spanish economy when they

take the form of closures. They also have some harmful effects (welfare and GDP reductions) as well as positive outcomes on employment creation and unemployment reduction in the case of national acquisitions."

Table 6: Sensitivity analysis

	National Acquisitions			Closures		
	Employment	Unemployment rate	Wages	Employment	Unemployment rate	Wages
Base: All divestments	1.00	-3.55	0.24	-1.49	11.00	-0.74
Elasticity of substitution between savings and consumption (σCA = 1)						
σ'CA = 2	0.99	-3.60	0.24	-1.50	10.99	-0.74
σ'CA = 0.5	1.00	-3.52	0.24	-1.48	11.00	-0.74
Elasticity of substitution between consumption and leisure (σCO = 1)						
σ'CO = 2	0.89	-6.37	0.43	-1.74	8.08	-0.54
σ'CO = 0.5	1.06	-1.87	0.13	-1.34	12.62	-0.85
Elasticity of substitution among consumption godos (σBC = 1)						
σ'BC = 2	1.09	-3.47	0.23	-1.64	12.25	-0.82
σ'BC = 0.5	1.00	-3.67	0.25	-1.28	9.53	-0.64
Elasticity of substitution between labour and capital (σLK = Narayanan and Walmsley, 2008)						
σ'LK = σLK * 2	0.99	-3.43	0.23	-1.75	12.53	-0.84
σ'LK = σLK * 0.5	1.00	-3.55	0.24	-1.27	9.79	-0.66
Armington trade elasticity (σ'A = Narayanan and Walmsley, 2008)						
σ'A = 7.5	0.25	-1.35	0.09	-0.67	5.36	-0.36
Real wage flexibility with respect to the unemployment rate (β = 1.5)						
β' = 0.001	0.71	-0.01	0.56	-0.38	0.01	-1.35
β' = 20	1.18	-5.85	0.03	-2.62	22.18	-0.11

Appendix 2: Model equations

As general rule, the notation in the model is as follows: endogenous variables are denoted by capital letters, exogenous variables by capital letters with a bar, and parameters by small Latin and Greek letters. There are 23 (i, j = 1,…, 23) production sectors and each sector produces one good. The model's equations are as follows, and variables and parameters are listed below.

A. 1. Production

The nested technology presents constant returns to scale and a competitive pricing rule. Given that the top nest is a Leontief function, the zero-profit condition for domestic firms and MNEs in sector i are, respectively:

$$PROFIT_i^{X\_DOM} = PX\_DOM_i - c\_dom_{0i} PVA\_DOM_i - \sum_{j=1}^{23} c\_dom_{ji} PO_j \left(1 + TAU.it_i^{II}\right) = 0$$

(i = 1,…, 23) **(A1)**

$$PROFIT_i^{X\_MNE} = PX\_MNE_i - c\_mne_{0i} PVA\_MNE_i - \sum_{j=1}^{23} c\_mne_{ji} PO_j \left(1 + TAU.it_i^{II}\right) = 0$$

(i = 1,…, 22) **(A2)**

where, according to the nested structure, the unitary cost of the value added composite generated by sector i is a CES function:

$$PVA\_DOM_i = \frac{1}{\alpha\_dom_i}\left(a\_dom_i^{\sigma_i^{LK}} \left(1 + soc_i\right)^{1-\sigma_i^{LK}} W^{1-\sigma_i^{LK}} + \left(1 - a\_dom_i\right)^{\sigma_i^{LK}} R\_DOM_i^{1-\sigma_i^{LK}}\right)$$

(i = 1,…, 21) **(A3)**

$$PVA\_MNE_i = \frac{1}{\alpha\_mne_i}\left(a\_mne_i^{\sigma_i^{LK}} \left(1 + soc_i\right)^{1-\sigma_i^{LK}} W^{1-\sigma_i^{LK}} + \left(1 - a\_mne_i\right)^{\sigma_i^{LK}} R\_MNE_i^{1-\sigma_i^{LK}}\right)$$

(i = 1,…, 21) **(A4)**

$$PVA\_DOM_i = \frac{1}{\alpha\_dom_i}\left(\begin{array}{l} a\_dom_i^{\sigma_i^{LK}} \left(1 + soc_i\right)^{1-\sigma_i^{LK}} W^{1-\sigma_i^{LK}} + \\ \left(1 - a\_dom_i\right)^{\sigma_i^{LK}} \left(aa\_dom_i R\_DOM + \left(1 - aa\_dom_i\right) R\_PUB\right)^{1-\sigma_i^{LK}} \end{array}\right)$$

(i = 22) **(A5)**

$$PVA\_MNE_i = \frac{1}{\alpha\_mne_i}\left(a\_mne_i^{\sigma_i^{LK}} \left(1 + soc_i\right)^{1-\sigma_i^{LK}} W^{1-\sigma_i^{LK}} + \left(1 - a\_mne_i\right)^{\sigma_i^{LK}} R\_MNE^{1-\sigma_i^{LK}}\right)$$

(i = 22) **(A6)**

$$PVA\_DOM_i = \frac{1}{\alpha\_dom_i}\left(a\_dom_i^{\sigma_i^{LK}} \left(1 + soc_i\right)^{1-\sigma_i^{LK}} W^{1-\sigma_i^{LK}} + \left(1 - a\_dom_i\right)^{\sigma_i^{LK}} R\_PUB_i^{1-\sigma_i^{LK}}\right)$$

(i = 23) **(A7)**

There is imperfect substitution between production made by domestic firms and MNEs. This is modelled through an Armington aggregate:

$$PROFIT_i^X = PX_i - \left(ax_i^{\sigma_i^A} PX\_DOM_i^{1-\sigma_i^A} + (1-ax_i)^{\sigma_i^A} PX\_MNE_i^{1-\sigma_i^A} \right) \quad (i=1,\ldots,22) \quad \textbf{(A8)}$$

We assume that firms maximize profits, and choose the optimal mix of national and imported goods, and that of domestic sales and exports. This leads to the next zero profit conditions:

$$PROFIT_i^A = PA_i - \left(e_i^{\sigma_i^A} PX_i^{1-\sigma_i^A} + (1-e_i)^{\sigma_i^A} \left(\overline{PFX}CUR\right)^{1-\sigma_i^A} \right)^{\frac{1}{1-\sigma_i^A}} \quad (i = 1,\ldots, 23) \quad \textbf{(A9)}$$

$$PROFIT_i^{CET} = PA_i - \frac{1}{\zeta_i}\left(d_i^{-\varepsilon_i} PO_i^{\varepsilon_i+1} + (1-d_i)^{-\varepsilon_i} \left(\overline{PFX}CUR\right)^{\varepsilon_i+1} \right)^{\frac{1}{\varepsilon_i+1}} \quad (i=1,\ldots,23) \quad \textbf{(A10)}$$

These zero profit conditions are used to get derived demand functions, by applying the Shepard's Lemma on cost functions.
Next, we introduce the corresponding market clearing equations, with demands and supplies showing in the left-hand and the right-hand side, respectively:

$$X\_DOM_i \left(-\frac{\partial PROFIT_i^{X\_DOM}}{\partial PO_j} \right) + X\_MNE_i \left(-\frac{\partial PROFIT_i^{X\_MNE}}{\partial PO_j} \right) = II_{ji}$$
$$(i,j = 1,\ldots, 23) \quad \textbf{(A11)}$$

$$X\_DOM_i \left(-\frac{\partial PROFIT_i^{X\_DOM}}{\partial R\_DOM_i} \right) = \overline{K_i^{RC\_DOM}} \quad (i = 1,\ldots, 23) \quad \textbf{(A12)}$$

$$X\_MNE_i \left(-\frac{\partial PROFIT_i^{X\_MNE}}{\partial R\_MNE_i} \right) = \overline{K_i^{RC\_MNE}} \quad (i = 1,\ldots, 22) \quad \textbf{(A13)}$$

$$X\_DOM_i \left(-\frac{\partial PROFIT_i^{X\_DOM}}{\partial R\_PUB_i} \right) = \overline{K_i^{PUB}} \quad (i = 22, 23) \quad \textbf{(A14)}$$

$$\sum_{i=1}^{23} \left(X\_DOM_i \left(-\frac{\partial PROFIT_i^{X\_DOM}}{\partial W} \right) + X\_MNE_i \left(-\frac{\partial PROFIT_i^{X\_MNE}}{\partial W} \right) \right) = \left(\overline{L} - Q_l\right)(1-U)$$
(A15)

$$X_i \left(-\frac{\partial PROFIT_i^X}{\partial PX\_DOM_i} \right) = X\_DOM_i \quad (i = 1,\ldots, 23) \quad \textbf{(A16)}$$

$$X_i \left(-\frac{\partial PROFIT_i^X}{\partial PX\_MNE_i} \right) = X\_MNE_i \quad (i = 1,\ldots, 22) \quad \textbf{(A17)}$$

$$A_i \left(-\frac{\partial PROFIT_i^A}{\partial PX_i} \right) = X_i \quad (i = 1,\ldots, 23) \quad \textbf{(A18)}$$

$$A_i \left(-\frac{\partial PROFIT_i^A}{\partial FC_i} \right) = IMP_i \quad (i = 1,\ldots, 23) \quad \textbf{(A19)}$$

$$A_i \left(-\frac{\partial PROFIT_i^{CET}}{\partial PO_i} \right) = O_i \quad (i = 1,\ldots, 23) \quad \textbf{(A20)}$$

$$A_i\left(-\frac{\partial PROFIT_i^{CET}}{\partial FC_i}\right)=EXP_i \qquad (i=1,\ldots,23) \qquad \textbf{(A21)}$$

$$X_i = X\_DOM_i + X\_MNE_i \qquad (i=1,\ldots,23) \qquad \textbf{(A22)}$$

$$X_i + IMP_i = O_i + EXP_i \qquad (i=1,\ldots,23) \qquad \textbf{(A23)}$$

$$I_i + \sum_{i=1}^{23} II_{ij} + FC_i = O_i \qquad (i=1,\ldots,23) \qquad \textbf{(A24)}$$

A. 2. Consumption

The final demand functions are derived from the maximization of the representative consumer's nested welfare function:

$$WF = \left(Q_c\right)^{1-\tau_{sav}}\left(Q_{sav}^{priv}\right)^{\tau_{sav}} \qquad \textbf{(A25)}$$

subject to the budget constraints:

$$Y_{RC} = W\left(\overline{L}-Q_l\right)(1-U)+\sum_{i=1}^{23} R\_DOM_i\,\overline{K_i^{RC\_DOM}} + \sum_{i=1}^{22} R\_MNE_i\,\overline{K_i^{RC\_MNE}} + \overline{NTPS} \qquad \textbf{(A26)}$$

$$Y_{RC} = PRIVSAV + \sum_{i=1}^{22} PO_i\left(1+TAU.it_i^{FC}\right)FC_i^{RC} \qquad \textbf{(A27)}$$

where:

$$PRIVSAV = P_{sav}Q_{sav}^{priv}$$

The nests in the welfare function are defined by:

$$Q_c = \left(b^{\sigma^{CL}}Q_{cg}^{1-\sigma^{CL}} + (1-b)^{\sigma^{CL}}Q_l^{1-\sigma^{CL}}\right)^{\frac{1}{1-\sigma^{CL}}} \qquad \textbf{(A28)}$$

$$Q_{cg} = \prod_{i=1}^{22}\left(FC_i^{RC}\right)^{\tau_i} \qquad \textbf{(A29)}$$

Consumption goods are purchased by the representative consumer and the public sector:

$$FC_i = FC_i^{RC} + FC_i^{PUB} \qquad (i=1,\ldots,23) \qquad \textbf{(A30)}$$

The solution to the maximization problem yields the demand functions for savings, leisure, and final demand.

A. 3. Public Sector

The income of the public sector is given by:

$$Y_{PUB} = \sum_{i=22,23} R\_PUB_i\,\overline{K_i^{PUB}} + \sum_{i=1}^{23}\left(SOC_i + IT_i\right) - \overline{NTPS} \qquad \textbf{(A31)}$$

where revenues come from several taxes:

$$SOC_i = Wsoc_i\left(X\_DOM_i\left(-\frac{\partial PROFIT_i^{X\_DOM}}{\partial W}\right) + X\_MNE_i\left(-\frac{\partial PROFIT_i^{X\_MNE}}{\partial W}\right)\right) \qquad (i=1,\ldots,23) \qquad \textbf{(A32)}$$

$$IT_i = TAU.it_i^{II}\left(\begin{array}{l} PX\_DOM_i X\_DOM_i\left(-\dfrac{\partial PROFIT_i^{X\_DOM}}{\partial PO_i}\right) + \\ PX\_MNE_i X\_MNE_i\left(-\dfrac{\partial PROFIT_i^{X\_MNE}}{\partial PO_i}\right) \end{array}\right) + PO_i I_i TAU.it_i^{GKF} + PO_i FC_i TAU.it_i^{FC}$$

$$(i = 1,\ldots, 23) \qquad \textbf{(A33)}$$

The macro closure rule is:

$$Y_{PUB} - \sum_{i=1}^{23} PO_i \left(1 + TAU.it_i^{FC}\right) FC_i^{PUB} = PUBSAV \qquad \textbf{(A34)}$$

where:

$$PUBSAV = P_{sav} Q_{sav}^{pub}$$

A. 4. Foreign sector, investment and savings

The macro closure of the model involves some other constraints related to investment and savings in this open economy:

$$\sum_{i=1}^{23} \overline{PFXEXP_i} + \overline{FORSAV} = \sum_{i=1}^{23} \overline{PFXIMP_i} \qquad \textbf{(A35)}$$

$$PRIVSAV + PUBSAV + \overline{FORSAV} = \sum_{i=1}^{23} PO_i \left(1 + TAU.it_i^{GKF}\right) I_i \qquad \textbf{(A36)}$$

A. 5. Factor Markets

The equilibrium in the capital market is given in **(A6)**, and the equilibrium in the labour market in **(A7)**, with some restrictions related to the unemployment assumptions:

$$\frac{W}{CPI} = \left(\frac{1-U}{1-\overline{U0}}\right)^{\frac{1}{\beta}} \qquad \textbf{(A37)}$$

$$CPI = \frac{\sum_{i=1}^{23} \theta_i PO_i}{\sum_{i=1}^{23} \theta_i \overline{PO_i}} \qquad \textbf{(A38)}$$

Table A1. Endogenous Variables

Symbol	Definition
A_i	Armington aggregate (total amount of goods supplied) of sector i
CPI	Consumer Price Index
CUR	Factor of conversion of foreign currency into domestic currency
EXP_i	Exports of sector i
FC_i	Final domestic consumption of goods produced by sector i
FC_i^{RC}	Final private consumption of goods produced by sector i
FC_i^{PUB}	Final public consumption of goods produced by sector i
I_i	Investment (gross capital formation) in goods produced by sector i
II_{ij}	Intermediate inputs from sector j used by sector i
IMP_i	Imports from sector i
IT_i	Indirect taxes revenue in sector i
O_i	Production of sector i sold in the domestic market
P_{sav}	Savings shadow price
PA_i	Unit cost of the Armington aggregate of sector i

PO_i	Unit cost of the production of sector i sold in the domestic market
$PRIVSAV$	Private savings
$PROFIT_i^A$	Unit profits for A_i (according to origin)
$PROFIT_i^{CET}$	Unit profits for A_i (according to destination)
$PROFIT_i^X$	Unit profits for X_i
$PROFIT_i^{X\_DOM}$	Unit profits for X_DOM_i
$PROFIT_i^{X\_MNE}$	Unit profits for X_MNE_i
$PUBSAV$	Public savings
$PVA_i^{X\_DOM}$, $PVA_i^{X\_MNE}$	Unit cost of primary inputs used by domestic and MNEs firms in sector i
PX_i	Price of the goods produced by sector i
PX_DOM_i	Price of the goods produced by domestic firms in sector i
PX_MNE_i	Price of the goods produced by MNEs in sector i
Q_c	Demand for aggregate consumption
Q_{cg}	Demand for aggregate consumption of goods
Q_l	Demand for leisure
Q_{sav}^{priv}, Q_{sav}^{pub}	Private and Public demand for savings
R_DOM_i, R_MNE_i, R_PUB_i	Capital rental rates in sector i
SOC_i	Revenue from social contributions paid by employers and employees of sector i
TAU	Endogenous multiplier for revenue neutrality
U	Unemployment rate
W	Wages
WF	Welfare
X_i X_DOM_i, X_MNE_i	Production of sector i
Y_{RC}	Disposable income of the representative consumer
Y_{PUB}	Disposable income of the public sector

Table A2. Exogenous Variables and Parameters

Symbol	Definition
$\overline{FORSAV}$	Foreign savings
$\overline{K_i^{RC\_DOM}}$, $\overline{K_i^{RC\_MNE}}$	Capital endowment of the representative consumer to produce good i
$\overline{K_i^{PUB}}$	Capital endowment of the public sector to produce good i
$\overline{L}$	Labour endowment
$\overline{NTPS}$	Net transfers from the representative consumer to the public sector
$\overline{PFX}$	World prices
$\overline{PO_i}$	Benchmark Prices
$\overline{U0}$	Benchmark Unemployment rate

a_dom_i,a_mne_i, aa_dom_i, ax_i, b, c_dom_{0i}, c_mne_{0i}, c_dom_{ji} c_mne_{ji}, d_i, e_i	Share parameters
it_i^{II} ,it_i^{GKF} ,it_i^{FC}	Indirect taxes rates, *ad valorem*, in sector i, that burden intermediate inputs, investment and final consumption, respectively
soc_i	Social contributions rates, *ad valorem*, paid in sector i
α_dom_i,α_mne_i ζ_i	Scale parameters
β	Sensibility parameter real wages-unemployment rate
ε_i	Elasticity of transformation in sector i
θ_i	Share parameters
σ_i^A	Armington elasticity of substitution in sector i
σ^{CL}	Elasticity of substitution between consumption and leisure
σ_i^{LK}	Elasticity of substitution between labour and capital in sector i
τ_i,τ^{sav}	Share parameters